

REMARKS

Claims 1-9, 11, 18 and 20 have been amended, claims 12-17 have been cancelled without prejudice, and claims 21-26 have been added such that claims 1-11 and 18-26 remain pending in this application. No new matter has been added by this amendment. Applicant respectfully requests reconsideration of the pending claims in view of the above amendments and the following remarks.

With regard to the drawing objections, Applicant appreciates the Examiner's attention to the details of the drawings, and has concurrently added reference numbers to the relevant figures in a replacement drawing sheet for FIG. 2 that is separately filed herewith. Applicant notes that reference numerals for elements 225 and 290 appear on originally filed FIG. 3. The remaining reference numbers have been added to FIG. 2. With regard to the reference numbers in FIG. 1, Applicant notes that the reference numbers are mentioned in the description of that figure found in the Background section of the specification (*e.g.*, p. 3), and submits that no corresponding amendment to the specification should be required. In light of the foregoing, Applicant requests reconsideration and withdrawal of the objection to the drawings.

Applicant also appreciates the Examiner's attention to the dependency of the claims, and has corrected the informality noted with regard to claim 11. With the cancellation of claims 14 and 17, the objection to claims 11, 14, and 17 has been obviated.

Claims 1-20 have been objected to under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regarding as the invention.

Particularly, the Examiner has variously objected to the use of the acronym “AIM” in the claims. Applicant notes that the term AIM is described as “Asynchronous IP Mirroring” on page 6, line 3 of the specification. Nevertheless, Applicant has removed the reference to AIM in the claims and replaced the same with “asynchronous mirroring” throughout the claims. Applicant notes that the present invention and the claims are not necessarily limited to Internet Protocol as other protocols including but not limited to File Transfer Protocol may be implemented.

Applicant submits that the amended claims are presented with the requisite clarity and requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, second paragraph.

Claims 1-6 and 9-20 have been rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Application Publication US 2001/0052058 A1 to Ohran (hereinafter “Ohran”). This rejection is respectfully traversed.

Mirroring of data between separate locations is known. (see, *e.g.*, Applicant’s specification, p. 2). Such systems attempt to provide mirroring synchronously. *Id.* They also typically deploy specialized hardware and customized communication infrastructure, and implement a write to disk remotely by replicating the entire write to the local disk on the remote disk as part of the overall write operation. *Id.* Making the remote write part of the process may introduce delays to write operations. *Id.* Other problems such as lack of system resiliency and potential loss of mirror coherency due to link failure or congestion may be encountered. (*Id.*, page 4).

Applicant’s invention offers mirroring at a remote storage device by intercepting I/O transactions to a storage disk of a local storage system, retaining and encapsulating the (*e.g.*, write) transactions into a series of local file system files, and transmitting such files to the remote

storage system via a non-proprietary network protocol. This provides several advantages not believed to be present in conventional systems. First, it does not introduce delays because it does not make local storage operations dependent upon completion at the remote location. It also retains a transaction level record of (e.g., write) I/O transactions that allows a return to any point on a per-transaction basis in the event of failure on either the local or remote storage side. Finally, it performs these tasks using standard file system files and non-proprietary network communication protocols (e.g., IP and/or FTP), which introduces flexibility and resiliency to the system.

For example, claim 1 recites *[a] system for mirroring write operations from a local storage system onto a remote storage system, the system comprising:*

an asynchronous mirroring driver resident in the local storage system for intercepting I/O transactions to a storage disk of the local storage system, identifying a series of write transactions to said storage disk, making a copy of the series of write transactions, and storing said copy in at least one of a series of files that are created on a file-system of the local storage system without requiring a consolidation of the series of write transactions;

a first asynchronous mirroring coordinator resident on the local storage system for invoking a file transfer system to transmit the series of files on the local file-system of the local storage system to a file system of the remote storage system via a non-proprietary network protocol; and

a service that sends the series of files to a network to which a remote storage system is connected.

These claimed features are neither disclosed nor suggested by Ohran. Ohran discloses a system for mirroring and archiving mass storage. In the Ohran system, at various points in time, a primary storage and a secondary storage are synchronized to contain the same data. Following a synchronization (e.g., at t_0), changes to the primary storage are tracked on the primary storage system side. The changes to primary storage that are made between the synchronization time (t_0)

and a following point in time (e.g., t_1) are consolidated into what is referred to as an update file.

The update file contains consolidated changes to the primary storage, rather than a per-transaction record of the changes to the primary storage. It is these update files that are then transmitted to the remote storage system in support of an update to the remote storage device.

While the features of Ohran may be useful in overcoming certain problems of storage mirroring systems, the solution offered by Ohran is clearly distinct from and in no way suggests the features of Applicant's claimed invention. For example, with regard to claim 1, Ohran clearly does not *identify[] a series of write transactions to said storage disk, mak[e] a copy of the series of write transactions, and stor[e] said copy in at least one of a series of files that are created on a file-system of the local storage system* as recited in the claim. The consolidated storage update is not a per-transaction record of transactions to the storage disk, but rather is a consolidated piece of information that in no way presents all of the information that Applicant's per-transaction record does. Moreover, there is clearly no retention of the write transactions in a file *without requiring a consolidation of the series of write transactions* as claimed by Applicant. Still further, there is certainly no transmission of a file containing the per-transaction record to the remote storage system, also as claimed by Applicant.

With Applicant's claimed invention, the per-transaction record of transactions accommodates an updating of the remote disk to reflect the status of the local storage disk at any point in time at the transaction level of granularity. Thus, for example, if it is 8 pm and the administrator desires the status of the disk as of any time, say 4:15 pm, the administrator may easily invoke the system to accommodate such a desire because of the presence of the transaction level record that is retained on the remote storage system side. With existing systems such as Ohran, there is a restricted synchronization event, followed by retention only of a consolidated

update and, moreover, there is no mention whatsoever of retaining a transaction level record on either the local or remote end corresponding to time preceding the synchronization event. By contrast, with Applicant's claimed invention such information may be retained on the remote side, which again may support an update to any point in time before or after a synchronization event, again at the transaction level of granularity.

If anything, Ohran teaches away from the features recited in Applicant's claimed invention. For example, Ohran states that:

Because the time sequence of changes occurring between time T0 and time T1 likely includes multiple changes to a single storage location of primary mass storage 20, the tracked changes represented by block 60a are consolidated in an update. The update contains only the last change made to any storage location before time T1 and therefore the update only contains the minimum data necessary to bring secondary mass storage 24 current with primary mass storage system 20 as of time T1. As disclosed previously, consolidation of the tracked changes illustrated at block 60a can be consolidated on-the-fly or at time T1.

The embodiment illustrated in FIG. 3 places a copy of the T0-T1 update in cache holding area 22 of primary mass storage 20 and transfers a copy of the T0-T1 update to secondary system 14 using communication link 16. Block 70 represents the cache holding area copy and block 52 represents the secondary mass storage copy. Once an update is created, the corresponding time sequence of changes is no longer necessary. Thus, block 60a, representing the tracked changes between time T0 and time T1, is temporary in nature and can be deleted after the corresponding update is created.

(Ohran, p. 9, ¶¶0077,0078.)

Whether describing the "on the fly" or other embodiments, Applicant submits that Ohran fails to disclose transmitting a file containing a per-transaction record of primary storage changes to the remote storage system, and teaches away from any such system as noted, for example, in the specification sections cited above.

Accordingly, Applicant submits that claim 1, and, for similar reasons, independent claims 3 and 5 are neither disclosed nor suggested by Ohran, and respectfully requests reconsideration of those claims.

Applicant also submits that dependent claims 2, 4, 6, and 9-11 and 18-20 are distinct from Ohran for incorporating the features of their respective independent claims, and for the features separately recited therein.

Particularly, claims 2, 4 and 6 variously recite receipt of the series of write transactions at the remote storage system, and corresponding issuance of the write transactions to the remote storage device. Clearly, Ohran's consolidated update file does not entail these features. Nor does Ohran disclose or suggest intercepting all I/O transactions, including those that affect the content or organization of the disk, in the context of providing a per-transaction basis recorded file as variously claimed by Applicant's claims 9-11 and 18-20.

Accordingly, Applicant requests reconsideration and withdrawal of the rejection of claims 1-6, 9-11 and 18-20 under 35 U.S.C. § 102.

Claims 7-8 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Ohran in view of U.S. Patent No. 5,673,382 to Cannon et al. (hereinafter "Cannon"), and claim 8 has been rejected under the same statutory section, as being unpatentable over Ohran in view of Cannon and U.S. Patent No. 5,713,014 to Durflinger et al. ("Durflinger"). These rejections are respectfully traversed.

Claims 7 and 8 incorporate the features of claim 1 and are neither disclosed nor suggested by Ohran, Durflinger and Cannon, or any of the three references taken alone or in combination, for the reasons set forth in detail above. Namely, there is no disclosure or suggestion of intercepting and retaining a series of write transactions, storing the same in one of a series of

files, and sending the same to a remote storage system as claimed by Applicant. Moreover, claims 7 and 8 add features found in the files that contain the above content. Since even the basic elements of such files are not found in the cited references, clearly there is also a failure to disclose the particulars recited in claims 7 and 8.

Indeed, even presuming that the basic elements were present, which is not the case, the Cannon and Durflinger references would not remedy the deficiencies of Ohran. Rather, in the passage cited by the Examiner, Cannon appears to describe locating a file by noting its offset within a storage volume. (Cannon, 8:41-46). This does not disclose the presentation of a write transaction in a file, and corresponding inclusion of the size of the file itself, or offset information as claimed. Durflinger discloses a database management system, with description of the use of pointers to locate data positions and such within files. Clearly, Durflinger also fails to remedy the above described deficiencies of Ohran (and Cannon). Accordingly, even if the Examiner's attempt at hindsight reconstruction of Applicant's claimed invention were permissible (which is not the case), the combination offered would still fail to yield the features recited in the claims.

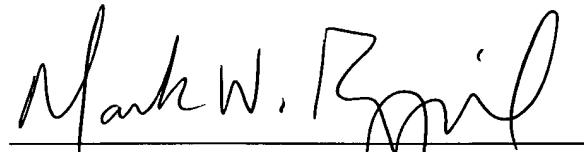
Accordingly, Applicant requests reconsideration and withdrawal of the rejection of claims 7-8 under 35 U.S.C. § 103.

Dependent claims 21-26 have been added and disclose additional features that are also neither disclosed nor suggested by the references relied upon by the Examiner.

For the foregoing reasons, Applicant requests reconsideration and withdrawal of the rejection of claims, and allowance of the claims that remain pending in the application.

Should the Examiner believe that anything further is desirable to place the application in condition for allowance, the Examiner is invited to contact Applicant's undersigned representative at the telephone number listed below.

Respectfully Submitted,



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